REMARKS

Claims 1-20 are pending in the case. Claims 1-4, 7-13 and 16-20 are rejected. Claims 5-6 and 14-15 are objected to as being dependent upon a rejected base claim but are allowable if rewritten in independent form. Reconsideration is respectfully requested.

§102(b) Rejection

Claims 1, 4, 7-13 and 16-20 are rejected under §102(b) as being anticipated by Bakhle et al. (U.S. Patent No. 6,061,092; hereinafter "Bakhle"). The Examiner contends that Bakhle discloses every limitation of the rejected claims. Applicant respectfully traverses the rejection.

Bakhle discloses a method for dark frame cancellation for CMOS sensor-based tethered video peripherals. The Abstract of Bakhle explains the basic operation of the method:

> Elimination of dark fixed pattern noise (DFPN) for tethered CMOS sensor-based digital video cameras is supported by supplying and **maintaining a host-based dark image cache**. Since the camera is tethered to a host computer system such as a PC, it takes advantage of the storage and processing capabilities of the host to manage the cache. By using a dark image cache for updating of the currently applicable dark image for DFPN cancellation processing, operation of the camera shutter for acquiring dark images is dramatically reduced, thereby using less system resources such as power, and increasing the MTBF of the electromechanical devices such as the camera shutter and associated controls. **Dark images are obtained at different integration, gain, and temperature operating characteristics of the camera and stored in the cache**. **The cached dark images are referenced on the host according to a fixed, predetermined dark column of data in video frames** generated by the CMOS sensor image array of the camera. The dark column data represents a portion of the CMOS sensor image array which is permanently and totally shadowed for use during DFPN cancellation processing. (Bakhle, Abstract, emphasis added.)

As explained by Bakhle, the dark frame cancellation method of Bakhle requires acquiring and storing a large number of dark images in a host computer and then retrieving the dark images

from the host computer based on different operation parameters of the camera. The method of Bakhle requires large amount of memory and requires the image sensor to be tethered to a host computer which is not practical for portable applications, as explained in Applicant's specification, paragraph [0008].

In the relevant section of Bakhle referenced by the Examiner (col. 2, lines 39 et seq., and col. 4 lines 26 et seq.), Bakhle describes storing "a plurality of dark images" in the dark image cache where the dark images are accessed via a dark column reference data array. Bakhle states that "[e]ach entry in the dark column reference data array references an associated dark image and represents a signature of a particular operating environment of the camera" (col. 4, ln. 36-39). Then, when the video camera is initialized, the operating characteristics of the camera are used to select which dark image from the dark image cache to be used. More specifically,

> When a new dark image is to be used, **dark column reference data array 48 is accessed to locate an entry matching the current operating characteristics**. The current operating characteristics are identified by selected dark column reference data. **When a match is found, the associated dark image is downloaded over bi-directional interface 34 to the video camera to become the new dark image (I) for DFPN cancellation processing**. The matching operation uses data generated from an image under a dark column in the CMOS image sensor array 36 as a signature of the entire dark image. This signature is matched to entries in the dark column reference data array 48. The signature is obtained from one frame of a stream of video frames generated by the CMOS sensor image array 36. (Bakhle, col. 4, ln. 49-62, emphasis added.)

In short, Bakhle describes a system and method where multiple dark images are stored, each dark image being associated with an entry in the reference data array. The operating condition of the camera is used to select an entry in the reference data array. The entry in the reference data array then indexes the desired dark image.

Claim 1

Claim 1, as filed, recites:

> 1. A method for subtracting fixed pattern noise in a digital imaging system incorporating a digital image sensor, comprising:

acquiring a reference image of the digital image sensor when the digital image sensor receives no illumination;

storing a reference value of an operating parameter associated with the reference image, wherein the reference image is indicative of the fixed pattern noise associated with the digital image sensor when the operating parameter has the reference value;

storing a model describing the behavior of the fixed pattern noise as a function of the operating parameter;

acquiring a first image;

measuring a current value of the operating parameter associated with the first image;

calculating a noise prediction image by extrapolation of the reference image in accordance with the model and based on the current value and the reference value of the operating parameter; and

subtracting the noise prediction image from the first image to generate a final image. (Emphasis added.)

Claim 1 is patentable over Bakhle at least because Bakhle fails to teach or suggest "storing a model describing the behavior of the fixed pattern noise as a function of the operating parameter" and "calculating a noise prediction image by extrapolation of the reference image in accordance with the model and based on the current value and the reference value of the operating parameter," as recited in claim 1. Bakhle does not teach or suggest any "model" whatsoever describing the behavior of the fixed pattern noise as a function of the operating parameter. Bakhle merely stores an array of reference data. Moreover, Bakhle does not teach or suggest calculating a noise prediction image by extrapolation from the single reference image. Rather, Bakhle uses the reference data to merely index one of many stored dark images.

An important distinction between Bakhle and the claimed invention is that Bakhle requires storing a large number of dark images, each associated with certain reference data. To the contrary, the claimed invention of claim 1 requires only a single reference image for a given operating condition. Extrapolation from the single reference image is performed to provide dark images for other operating conditions. For these reasons, Bakhle does not teach or suggest the limitations of claim 1 and claim 1 is patentable over Bakhle.

Claims 4 and 7-10

Claims 4 and 7-10, dependent upon claim 1, are patentable over Bakhle at least for the same reasons that claim 1 is patentable.

Claims 11-13 and 16-20

Claim 11 is patentable over Bakhle at least by reciting "a memory buffer…for storing a reference image of the sensor array and a reference value of an operating parameter, wherein the reference image is indicative of the fixed pattern noise associated with the digital image sensor…" and "the second processor generates the noise data by extrapolating the reference image based on the reference value and the current value of the operating parameter and a model describing the behavior of the fixed pattern noise as a function of the operating parameter." For the same reasons described above with reference to claim 1, Bakhle does not teach or suggest storing a single reference image and using extrapolation to generate the noise data. Claim 11 is patentable over Bakhle.

Claims 12, 13 and 16-20, dependent upon claim 11, are patentable over Bakhle at least for the same reasons that claim 11 is patentable.

For the above reasons, withdrawal of the §102(b) rejection is respectfully requested.

§103(a) Rejection

Claims 2 and 3 are rejected under §103(a) as being unpatentable over Bakhle in further view of Acks et al. (U.S. Patent 5,912,934; hereinafter "Acks"). The Examiner contends that the combination of Bakhle and Acks discloses every limitation of the rejected claims. Applicant respectfully traverses the rejection.

For the reasons described above with reference to claim 1, claim 1 is patentable over Bakhle. Claims 2-3, dependent upon claim 1, are patentable over Bakhle at least for the same reasons that claim 1 is patentable. Acks does not cure the deficiency of Bakhle. The Examiner cited Acks for describes averaging of pixel values to form the reference image. However, the combination of Bakhle and Acks still does not teach or suggest storing a model and calculating a noise prediction image by extrapolation from a single reference image, as discussed above.

For these reasons, withdrawal of the §103(a) rejection is respectfully requested.

Allowable Subject Matter

Claims 5-6 and 14-15 are objected to as being dependent upon a rejected base claim but are allowable if rewritten in independent form. For the reasons stated above, independent

claims 1 and 11 are patentable over the cited reference, claims 5-6 and 14-15 are therefore in condition for allowance.

CONCLUSION

Claims 1-20 are pending in the present application. For the reasons stated above, claims 1-20 are patentable over the cited references. The application is therefore in condition for allowance and passage of the present case to allowance is respectfully requested. If the Examiner would like to discuss any aspect of this application, the Examiner is invited to contact the undersigned at (408) 382-0480.

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/Carmen C Cook/	April 24, 2007
Attorney for Applicant(s)	Date of Signature

Respectfully submitted,

/Carmen C Cook/

Carmen C. Cook
Attorney for Applicant(s)
Reg. No. 42,433
Patent Law Group LLP
2635 N. First St.
Suite 223
San Jose, CA 95134
Tel (408) 382-0480 x208
Fax (408) 382-0481